

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information		
Name	Antonia Sattler	
Student number	6071449	
Studio		
Name / Theme	Chair for Design Informatics and Graduation Studio for Lunar Architecture and Infrastructure	
Main mentor	Dr. Michela Turrin	Adaptive Architecture
Second mentor	Dr. Henriette Bier	Space Architecture
Argumentation of choice of the studio	The chosen departments provide expertise from the two main areas relevant for this research – adaptive architecture provided by the Chair of Design Informatics and space architecture provided by Graduation Studio for Lunar Architecture and Infrastructure	
Graduation project		
Title of the graduation project	Neuro-adaptive Architecture in Extreme Environments	
Goal		
Location:	Delft	
The posed problem,	Stressors in extreme environments have a severe impact on the occupant's health and can potentially lead to dysregulation of physiological systems, specifically allostasis. For the set-up of an adaptive Visual Quality (VQ) system that can counteract immediate stress (to prevent long-term consequences), reliable data of the individual physiological and psychological effects of VQ on biomarkers is needed.	
research questions and	1. How can neuroarchitecture be used to investigate the effectiveness of VQ as a countermeasure for acute stress?	

	2. What are the challenges involved in cross-sectional research on this topic? 3. How can this data be used for neuro-adaptive architecture in extreme environments?
design assignment in which this result.	Neuroarchitectural study design, study execution and concept for the use of the resulting data in a space station
Process	
Method description	
The contribution of this thesis is two-fold, with the second part depending on the results of the first one. Part 1: Preliminary neuroarchitectural study investigating the influence of VQ on biomarkers in combination with non-architectural stressors The experimental design will employ quantitative data collection (biomarkers measured through biosensors like an ECG) and additional qualitative data collection methods (e.g. questionnaires). The exact execution of the study and the choice of investigated biomarkers still depends on the final lab environment and available equipment. Additionally, extraneous variables like discomfort/stress resulting from VR (if used), and the factor of time (short-term stress vs. long-term health consequences) must be considered. Participants will be recruited once the study is approved by the Human Research Ethics Committee. Slight changes in the research questions can still occur once the study design is final. For now, Part 1 of the thesis addresses the research questions 1 and 2: 1. How can neuroarchitecture be used to investigate the effectiveness of VQ as a countermeasure for acute stress? 2. What are the challenges involved in cross-sectional research on this topic? Part 2: Overview of research/system concept for the future investigation of allostatic overload in astronauts The second part constitutes a smaller portion of the thesis and builds upon the findings of Part 1. These findings (study results, findings about limitations, unexpected problems, solutions to these problems, etc.) will be used to define potential architectural solutions for the application of the study results and recommendations for further needed research. Part 2 therefore aims to answer research question 3. 3. How can this data be used for neuro-adaptive architecture in extreme environments?	

Literature and general practical references

Consultants:

German Space Agency (DLR)

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Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

The thesis fits well into the research of the Chair for Design Informatics through the focus on adaptive design, smart IEQ and biomarker-based design. It aligns very well with the goals of the Graduation Studio for Lunar Architecture and Infrastructure due to the clear commonality of extraterrestrial architecture. The relation to Building Technology and AUBS is clear as the topic units several different research areas (like space architecture, neuroarchitecture and adaptive architecture), thereby demonstrating the relevance of interdisciplinarity for solving complex architectural problems. Further, the thesis will utilize methods, that reflect current trends in architecture, like an increasingly scientific approach to architecture as demonstrated through the use of neuroarchitecture.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

The graduation topic aligns with current research efforts towards the development of human outposts in space for research purposes like demonstrated by NASA's and ESA's Artemis programme. Further, it is in conjunction with research trends about adaptive systems used to increase human comfort or to minimize energy consumption on Earth. It addresses relevant questions in the current research

landscape like how human and environmental needs can be balanced through interdisciplinary collaboration. Neuroarchitecture as well as adaptive architecture both play an increasingly important role, specifically in extreme environments where resources like space and energy are limited. With occupants spending a large portion of their time inside, which could potentially continue to increase due to climate change or pandemics, research on the effects of the IEQ on human health is needed. Neuroarchitecture can show where resources for ineffective comfort can be saved as part of a climate-neutral built environment and where resources should be invested to improve human health.